# 自治体における地震防災に貢献する正確かつ役に立つ地震情報およびその提供手法に関する研究 (3)

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# A Comprehensive and Effective Earthquake Information System: Contributions to Earthquake Hazard Mitigation for a Local Government (3)

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**Synopsis**

When significant earthquakes occur, local governments execute disaster prevention procedures, however, the administration staff often have little detailed information about the earthquake. As a result of a questionnaire survey, some discrepancies are recognized between the administration side and research side for the use of the earthquake information. The administrative side would like to have " accuracy " and the research side emphasizes " diversity ". What should be done to diminish this essential difference? As a convenient and effective method, a home page system is proposed.

**Keywords:** earthquake information, local government, earthquake disaster prevention

## 1. Main Purpose

This investigation has been carried out since 2003 as a part of the 21st century Centers of Excellence project for Natural Disaster Science and Disaster Reduction, and this is the 3rd annual report of the same title. We have reported on the previous progress in the two previous reports ( Umeda et al.,2004 ; Watanabe et al.,2005). Noguchi(2004) also mentioned about the database for this project.

In this section, the past results of this investigation are summarized. When a significant earthquake occurs, disaster prevention procedures are usually executed by local governments. Using the experience of the Hyogo-ken Nanbu earthquake, the Central Disaster Prevention Council settled on a disaster prevention program. Each local government studied this program and made their own appropriate disaster prevention plans. When a large disaster occurs, the local government acts according to the manual of the plan. In this paper, only the aspects of a earthquake disaster are considered.

Usually, a local government initiates its disaster prevention plan at seismic intensity 4 or greater. The seismic intensity information that is the basis of their actions are provided to the local government through the Japan Meteorological Agency and its related institutions. Also, information from mass media is sometimes used. Recently, the rapid earthquake information systems have also been developed.

The local government establishes a headquarters for disaster prevention and begins to execute countermeasure actions according to the scale of the earthquake intensity and the damage situation.

Although the initial information about the earthquake is transmitted to the local government quickly, there is little detailed information about the total amount of the seismic activity. The local government is obliged to collect such information on its own. Such information includes, the spatial expansion of aftershock area, decay of aftershock activity, prospect of future activity, and other earthquake related phenomena. Usually, there are many locally felt earthquakes in the focal region, but smaller events may not be reported sufficiently and the headquarters may not be fully aware of the activity. Lack of information may cause

anxiety for the residents.

We considered that providing detailed seismic information to the local government immediately after a major earthquake occurrence should be useful for executing a meaningful disaster prevention program. In providing this data, we want to know what practical information that the local government and residents truly desire. In addition, we want to consider how the information should be transferred. By conveying those requests to the earthquake researcher side, we will be able to improve the quality and quantity of information and the method of information transfer.

There are three reasons that Tottori prefecture was chosen as a cooperating local government of this joint research, as follows;

1) In Japanese historic times, the San'in district has been seismically active for the past 100 years with occurrences major earthquakes of Magnitude 7 or larger.

The Hamada earthquake (M7.1,1872), Northern Tango earthquake (M7.3,1927), Tottori earthquake (M7.2,1943) and Western Tottori-prefecture earthquake (M7.3,2000) have occurred causing great damage. So the local residents in this district have a great interest in the possible levels of seismic damage.

2) Kyoto University established the Tottori microearthquake observatory in 1964 and started microearthquake routine observation in the surrounding area. Since then, we have accumulated much knowledge about the seismic activity in the San'in district for more than 40 years.

3) It is well-known that Tottori prefecture provided effective correspondence for the Western Tottori-prefecture earthquake in 2000. Tottori prefecture also retains a positive posture for information disclosure.

For these reasons, Tottori prefecture and the Disaster Prevention Research Institute of Kyoto University made an agreement, and this investigation plan has been started.

Two years has passed and we realize that the reason why this project has been well developed is mainly due to the accommodation of the conditions mentioned above.

## 2. Current Progress

An information terminal was installed at the Tottori prefecture office in March 2004, and practical use of the system started. Tottori prefecture and Kyoto University entered into an agreement about the usage of the system. The system configuration is shown in Fig.1. The display

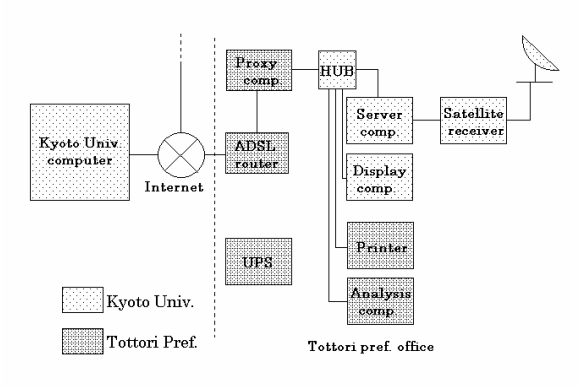


Fig. 1 Block diagram of the Tottori system (Umeda et al, 2004)

terminal of the system shows the earthquake information, including seismic activity information (hypocentral distribution, the number of earthquakes and spatio-temporal distribution), felt earthquake information and seismic waveforms. The seismic waveforms can be shown by use of a parabolic antenna installed on the roof of the prefectural office that receives the data. Other information are transmitted by phone line from the Research Center of Earthquake Prediction, D.P.R.I., Kyoto University.

The system is in practical test use at present, so there are domain restrictions on the system. Access is allowed to Kyoto University, Tottori prefecture, Tottori University and a few personal addresses of related persons.

Since the beginning of the practical use of the system, no significant earthquakes have occurred around the Tottori region, so Tottori prefecture has not initiated any caution states for the past two years. There are no cases yet for which this system was used for an actual emergency procedure , and there have been no evaluations of the system from actual practical use.

After a questionnaire survey of the members of Tottori prefecture was taken, several opinions from the administrative side were summarized. The results showed that there was an essential discrepancy between administration and research points of view.

Administrative side:

Accurate and guaranteed information (the information necessary for initiating action) are needed. The judgment about the information should not differ depending on the person. The information should be written in sentences and also digitized.

The research side:

The view of researchers is to offer as much information as possible. They often think that it is better not to hide

any information, even if the judgement is left to the users . The information from the research side generally lack explanations.

A summary of the accesses to this information as determined by the statistical software "Analog" (Turner,2004) is described below. Fig.2 is the monthly number of accesses. This is the total number of all access, so the differences between domains cannot be identified.

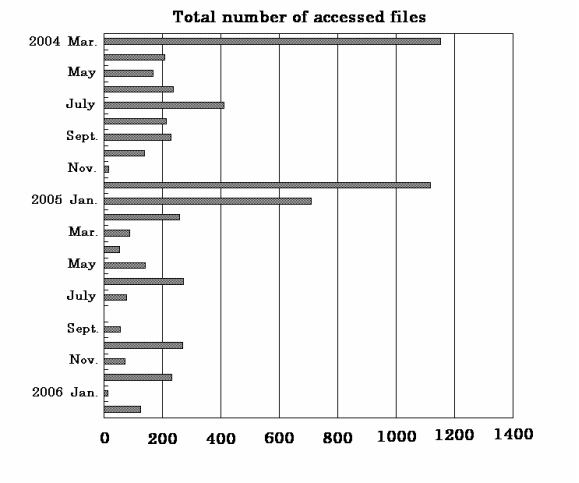


Fig. 2 Number of accessed files per 1 month. The system was settled at March 2004 and a questionnaire was carried out from December 2004 to January 2005. Two peaks can be explained by those circumstances.

First, the number of accesses was highest in March 2004, because of the establishment of the system. There were 1151 accesses during the 14 day interval until the end of March after the system was established on March 18th. This is equivalent to 82 accesses per day. This seems to have reflected the interest of the persons in charge. There were no access from Tottori University at this stage. One of our co-investigators moved to Tottori University in June of 2004, so access from Tottori University started at that time. The next peak was recognized in the period from December in 2004 to February in 2005. The questionnaire survey was distributed during this time, so the accesses by concerned persons, including prefecture staff, seem to have increased.

After that period, the number of accesses generally tends to decrease. Table 1 shows the access numbers for every period. The length of period varied, so the number of accesses per day is listed. This is the result for approximately 2 years. The statistical periods overlaps, but the number of accesses is decreasing gradually. Earthquakes with seismic intensity 3 or greater were recorded 5 times in Tottori prefecture during these 2 years as follows;

2004. 9. 5. Off Kii peninsula M7.1 seismic intensity 3
2004. 9. 5. Off Kii peninsula M7.4 seismic intensity 4
2004. 9. 7. Off Tokaido M6.5 seismic intensity 3
2004.10.13. East Shimane-pref. M3.3 sismici ntensity 3
2005. 3. 20. Western Off Fukuoka-pref. M7.0 intensity 3.

Except for the fouth event, these were all large distant earthquakes. The 4th event on October 13, 2004 occurred in eastern Shimane prefecture and had a seismic intensity 3 in Tottori (Yonago city), but the hypocenter was in neighboring prefecture of Shimane. Emergency response by the Tottori local government was not needed for any of these cases. An extreme increase of the access number was not recognized for all of these cases. It can be anticipated that the accesses from the local government will increase when a large earthquake occurs in the prefecture.

| period | Kyoto Univ. | Tottori Univ. | Tottori Pref. | Others | Total |
|---|---|---|---|---|---|
| 2004.Mar.18 | 990 | 0 | 552 | 844 | 2,386 |
| – 2004.Aug.31 | 5.93 | 0.00 | 3.31 | 5.05 | 14.29 |
| 2004.May 2 | 655 | 947 | 814 | 817 | 3,233 |
| – 2005.Jan.29 | 2.40 | 3.47 | 2.98 | 3.00 | 11.86 |
| 2005.Feb.1 | 268 | 391 | 179 | 108 | 946 |
| – 2005.Oct.5 | 1.09 | 1.59 | 0.73 | 0.44 | 3.81 |
| 2005.June 5 | 445 | 369 | 150 | 151 | 1,115 |
| – 2006.Feb.24 | 1.68 | 1.40 | 0.57 | 0.57 | 4.22 |
| 2005.July 3 | 454 | 172 | 149 | 136 | 911 |
| – 2006.Mar.12 | 1.80 | 0.68 | 0.59 | 0.54 | 3.61 |
| 2006.Mar.5 | 54 | 0 | 19 | 21 | 94 |
| – 2006.Apr.30 | 0.96 | 0.00 | 0.34 | 0.37 | 1.67 |

Table 1 Number of accessed files according to the institution. Total number of accessed files in the period indicated in the left is shown in the upper row and the number per 1 day in the lower.

## 3. New Problems

The purpose of this system is to offer the information that the university can obtain to the local government in order to be utilized for the disaster prevention program. Usually the earthquake information collected by the university are regarded as data only for research work, not for commercial nor civic use. So, the stability over a long period is not expected as a primary requirement. The contents of the information and the system itself are often changeable due to the circumstances of the communities of universities and other research institutions.

The present system of data transmission uses satellite telemetry, but this satellite system may be abolished by the

end of 2006. After the end of the satellite system, it is planned that the earthquake information network of the university group will be shifted to JGN2, which is a high qualifty terrestrial network system . The satellite system will no longer be used by the university group, but change of the system is a big problem for administration. For the Tottori system, the satellite transmissions will no longer be available. Furthermore, the 21st COE project is going to finish in this fiscal year. We would like the information system to remain as a contribution to society after the end of this project and Tottori prefecture also wants to continue to utilize this system. However, currently there are no specific plans nor funds for this from the university side. As an alternative idea for data dissemination, we would like to propose the home page system described in the next chapter.

## 4. Plans for Improvement

We talked with Tottori prefecture staff about future prospects of this system. The administration side recognizes that the earthquake information is useful for their disaster prevention program. It is the obligation for the research side to propose ideas for the future possibility of data information to the administration side.

Considering some problems which the present system involves, we concluded that a convenient homepage system with much more content would be preferable. In general, the homepage system can be easily and widely used. The information sent by satellite are not used in the system, therefore the maintenance becomes much easier. We hope to start the experimental practical use of this homepage in fiscal year 2006. The conditions that the system should satisfy are the following.

1) A homepage should be appealing and frequently accessed.

Ordinarily when large earthquakes are not occuring, the frequency of accesses to the earthquake information system are low. If there are few accesses, the earthquake information is not of great interest. Therefore, the potential of the earthquake information for the administrative persons does not increase. Furthermore, the administrative persons often change positions within in several years, and it is common that new members will cover this project. In general, the administrative person has many duties and does not concentrate on earthquake disaster prevention program. In order to raise the potential for earthquake prevention, it is necessary to increase the access frequency to the homepage.

To achieve more frequent accesses, the homepage should contain other attractive information related to earthquake disaster prevention and mitigation, in addition to the purely seismic information.

2) The home page should contain both attractive and specialized information.

At present, the seismic wave data are transmitted by the satellite as described above,. so, the maintenance of the system by members of the prefectural office side requires technical expertise and time. But, there was little use of the seismic wave monitoring. There may be two reasons why the seismic wave monitoring is not used. One is that the understanding seismic wave is a little difficult for non-seismologists, and the other is that there was not sufficient explanation about the seismic waves. So, the new homepage excludes the seismic wave monitoring that are currently being receiving satellite data at the prefecture office. When the wave monitoring is needed, it will be available by accessing the homepage of the university. Then, the maintenance on the prefecture side becomes more simple.

The information displayed on this new web site is classified into 3 types.

a) Accurate information which can be used for the disaster prevention program :

This information is offered by the Japan Meteorological Agency, and related institutions. This is authorized by the Japanese government and can be formally utilized for the disaster prevention program.

b) Added information (reference information) :

These are the data to assist and understand the authorized information mentioned above. Explanations about the authorized information are also included in this category.

c) Descriptions and comments :

These are the general descriptions about earthquake phenomena and seismic hazards, which include comments about various earthquake related problems. Geochemical and geomagnetic data, seismic activity in the past and information related the area are helpful for understanding the seismic activity. These are useful to improve the potential about earthquake information for the administrative persons in charge and the general users.

## 5. The Way to the Future

In this project, only Tottori prefecture was a cooperator

for this earthquake information system. The investigation system is to be studied jointly by a local government and a research institute, and is not a one-way street. The system needs the positive posture of the administration toward information disclosure. On the other hand, we researchers have accumulated knowledge about the past seismic activity in this district. Therefore, as the co-investigator, any local government might not be appropriate for this kind of project.

When considering the broad use of a system, easy utilization becomes possible by adopting a homepage system. There are some problems in the contents of information in this homepage system. For example, the utilization of the real-time seismic waveform becomes a little difficult. On the other hand, the merit is that many users can easily obtain the information.

As a result of the 2 year trial, the home page system described above is proposed as an effective information system. Since the system does not have exclusive lines and equipment, the congestion of the internet circuit may arise when a large earthquake occurs, but, usual access becomes much easier. Use from a wide area can be expected, and this must be effective to improve the potential use for earthquake disaster prevention. We plan to construct the model homepage during the last year of the 21st COE project.

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## 自治体における地震防災に貢献する正確かつ役に立つ地震情報およびその提供手法に関する研究（３）

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**要旨**

顕著な地震が発生した際は自治体によって防災対策が執られるが、行政担当者は詳細な地震情報をそれほど持っていない場合が多い。アンケート調査を行った結果、行政側と研究側には地震情報の利活用に関しての意識の違いが見られるようだ。行政側は情報の“正確さ”を最重視し、研究側は提供する情報の“広汎さ”を重視する。この違いを埋めるために何ができるか。簡便方法としてホームページ方式を提案する。

**キーワード**：地震情報、地方自治体、地震防災